

MWI 7120.6

REVISION B

EFFECTIVE DATE: December 16, 2003

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MARSHALL WORK INSTRUCTION

QS01

PROGRAM/PROJECT RISK MANAGEMENT

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		7/10/00	
Revision	A	5/15/01	Added reference 4.9. Added definitions 5.1, 5.4 a 5.5 and 5.7. Added planning responsibilities clarification into 6.1. Added responsibilities for GPMC and the Procurement Office into section 6.2 and reordered section to more logically follow process flow. Updated risk management tools application into section 6.3. Added procurement responsibilities into flow diagram.
Revision	B	12/16/2003	Removed reference from paragraph 6.3, Type III. Defined the GPMC in section 5.12. Made appropriate changes to bring in accordance with NPG 8000.4 throughout the document. Added the word "Continuous" in front of Risk Management throughout the document. Added NPG 8000.4 to the Applicable Documents section. Corrected the number references for S&MA OI's in the reference section. Corrected the title to MPD 1150.1 in the reference section. Added the word "may" prior to the word cause and removed "or prior" to the word loss in section 5.6. Added the words "The PHA" prior to the word provides in section 5.7. Added the words "an undesired" prior to the word consequence in section 5.8. Removed the last two sentences in section 6.1 and added section 6.1.1 which discusses MPG 2810.1. Added the words "a CRM" prior to the word plan. Also, changed the word "Presents" to Present in section 6.2.3. Added the words, "Organizations supporting programs/projects will also support the respective team" in section 6.2.6. Eliminated section 6.2.8 and added to the end of section 6.2.6 the words, "Periodically assess the risk management process to ensure risks continue to be managed throughout the project life cycle." In section 6.3 identified the Table as Table 6.3. Added a new line item (4.1.1) to the reference section and it was, "Schedule Risk Assessment Guide" - MSFC Project Analysis Office (RS40). Added to section 5 a new line item (5.1.1) which was a definition of Schedule Risk Assessment (SRA). Added a new line item for section 6.2 (6.2.9) which says, "The Actionees are Project or Program Manager and Project Analysis Office". Added to section 6.3 SRA to all three Program/Project Types. Added to section 6.3 SRA to the list risk management tools. Corrected section 6.2.8 to say, "S&MA evaluates implementation of risk management requirements in MSFC Programs and Projects. Added cost numbers to section 6.3 with regards to Type I, II and III. In the reference section deleted the 40 after QS for 4.2, 4.3 and 4.4.

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1. PURPOSE

This Instruction establishes the processes and responsibilities for the implementation of an effective continuous risk management (RM) process at Marshall Space Flight Center (MSFC). Continuous Risk Management is an essential process for managing MSFC's assets and programs.

2. APPLICABILITY

This Work Instruction applies to all MSFC-managed projects and programs and MSFC's facilities.

3. APPLICABLE DOCUMENTS

- 3.1 NPG 7120.5, "NASA Program and Project Management Processes and Requirements"
- 3.2 MPG 7120.1, "Program/Project Planning"
- 3.3 MPG 1410.2, "Marshall Management Directives System"
- 3.4 NPG 8000.4, "Risk Management Procedures and Guidelines"

4. REFERENCES

- 4.1 Dorofee, Audrey J., et al., Continuous Risk Management Guidebook. Carnegie Mellon University, 1996.
- 4.2 QS-R-001, "Failure Mode and Effects Analysis and Critical Items List"
- 4.3 QS-SS-011, "Procedures for Performing Hazard Analysis"
- 4.4 QS-R-009, "Reliability Prediction"
- 4.5 W.E Veseley, et al., NUREG 0492, Fault Tree Handbook, Government Printing Office, 1981.
- 4.6 NPG 8715.3, "NASA Safety Manual"
- 4.7 SSP 50431, "Space Station Requirements for Payloads"
- 4.8 MPD 1150.1, Charter Number MC-08, "MSFC Project Management Council"
- 4.9 NASA Procurement Notice 97-58

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4.10 MPG 2810.1, "Security of Information Technology"

4.11 MSFC, Project Analysis Office (RS40) "Schedule Risk Assessment Guide"

5. DEFINITIONS

5.1 Acceptable Risk. Acceptable risk is the risk that is understood and agreed to by the project/program, Governing Project Management Council (GPMC), and the customer sufficient to achieve defined criteria within an approved level of resources.

5.2 Fault Tree Analysis (FTA). A fault tree analysis is a graphical model of the various parallel and sequential combinations of faults that will result in the occurrence of a predefined undesired top-level event in a system.

5.3 Failure Mode and Effects Analysis (FMEA). An analysis that examines the conditions that can result in failures of components and the effects of the faults to the system in which they are contained.

5.4 Functional FMEA Approach. The functional FMEA approach is used when hardware items cannot be uniquely identified or when system complexity requires analysis from the initial indenture.

5.5 Hardware FMEA Approach. The hardware FMEA approach is used when hardware items can be uniquely identified from schematics, drawings, and other engineering and design data.

5.6 Hazard Analysis (HA). The determination of potential sources of danger and recommended resolutions for those conditions found in the hardware/software systems, the person/machine relationship, or both, which may cause loss of personnel capability, loss of system, or loss of life or injury.

5.7 Preliminary Hazard Analysis (PHA). The PHA is the foundation on which the rest of the safety analyses and the system safety tasks are built. It documents which generic hazards are associated with the design and operational concept. The PHA provides the initial framework for a master listing of hazards and associated risks that require tracking and resolution during the course of the program design and development.

5.8 Probabilistic Risk Assessment (PRA). A quantitative analysis of the probability of occurrence of an undesired

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consequence of interest, and the severity of that consequence, including assessment and display of uncertainties.

5.9 Risk. The combination of (1) the probability (qualitative or quantitative) that a program or project will experience an undesired event such as cost overrun, schedule slippage, safety mishap, failure to achieve technological breakthrough or failure to achieve mission objectives; and (2) the consequences, impact, or severity of the undesired event if it were to occur.

5.10 Continuous Risk Management (RM). An organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, communicates, and documents risk to increase the likelihood of achieving program/project goals.

5.11 Schedule Risk Assessment (SRA). A quantitative analysis of a project's scheduled task durations that provides a range of probable completion dates with the associated probabilities for each. If the schedule is resource loaded, a quantitative cost analysis may also be performed using the schedule data. This cost analysis would provide a range of probable project costs with probabilities for each. The SRA could provide the basis for project schedule margin and recommended budgetary reserves.

5.12 Governing Program Management Council (GPMC). A forum composed of NASA and/or Center Senior Management that assesses program and project planning and implementation, and provides oversight and direction as appropriate.

6. INSTRUCTIONS

6.1 Continuous Risk Management Process. Each program/project will follow a Continuous Risk Management (CRM) process; this process will be iterated throughout the program/project life cycle. The methods, tools, and level of effort dedicated to CRM may be tailored for each program/project, subject to the minimum requirements for program/project type, as specified in section 6.3. All programs/projects will be required to prepare a CRM plan during the program/project formulation phase. (Note: Even though the contractor or the upper NASA program level may have a RM plan, the program or project manager will need a RM plan because the contractor or the upper level program risks, roles and responsibilities, and risk assessment methods will be different.) This plan may be a supplement of the program/project plan. This process begins with risk identification and an assessment of program/project constraints. Risk areas will be analyzed to determine whether immediate mitigation planning is required. All risk areas will be tracked to monitor the

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effectiveness of the mitigation plans. The risk areas will be closed or replanned based on success of these metrics.

6.1.1 MPG 2810.1 defines the Information Technology Security RM planning, and risk assessment processes and activities. A flow diagram that describes the RM process is provided in section 11.

6.2 Responsibilities

Actionee

Action

Project or Program Manager	6.2.1	In the program/project plan, defines the scope of the CRM activities, including any program/project tailoring of risk management process defined in NPG 7120.5. Define the program/project acceptable risk and the type of program/project for minimum tool usage requirements (section 6.3).
Project or Program Manager	6.2.2	Ensure that CRM training is provided to program/project personnel.
Project or Program Manager	6.2.3	Prepare a CRM plan that contains roles and responsibilities, a schedule for risk process implementation, methods, and the tools. Presents the CRM process and plan to the GPMC during the approval phase as outlined in MPG 7120.1. After the CRM process and planning are approved, prior risk processes and risk statements will be promptly transitioned to be handled in accordance with the plan. Lessons learned data, expert opinion, and technical analysis will be used as an input to evaluate, classify, and prioritize risk. HA, FMEA, PRA, and FTA will be used to identify and analyze risk as required by section 6.3. Risk mitigation plans, risk acceptance rationale, and tracking requirements will be identified. The results of this process will be

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documented on a risk information sheet or an equivalent worksheet or data base. A sample risk information sheet is supplied in the Appendix. The reporting requirements will be specified in the plan.

- GPMC 6.2.4 In the approval phase, evaluates/concurs with program/project CRM process and planning including the defined level of acceptable risk, and the identification of the project type, scope of analysis for PRA, FMEA, FTA, and HA, as appropriate. If the GPMC approves the use of risk management tools that are not compliant with this MWI, the program/project manager will submit a waiver/deviation request that will be processed in accordance with MPG 1410.2.
- Procurement Office 6.2.5 Ensure that CRM is included in acquisition planning, as required by Reference 4.9.
- Safety and Mission Assurance (S&MA) Office, Project, or Program Team, and Engineering Directorate (ED) 6.2.6 Act as the facilitator of the CRM activities. S&MA will provide training upon request from the project or program manager. Provide input and guidance into the development of the CRM plan. Provide input in the development of the risk statements, risk analysis, and the risk mitigation plans. Organizations supporting programs/projects will also support the respective team as specified in the CRM plan that may include all or part of the activities described above. Periodically assess the CRM Process to ensure risks continue to be managed throughout the project life cycle.
- Project or Program 6.2.7 Routinely monitor risk metrics to

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Manager verify the effectiveness of the mitigating actions. The metrics will be used to decide whether to close the risk area or to modify the mitigation plan. The status of risk areas will be reported as required by the CRM plan.

Systems Management Office 6.2.8 Evaluates implementation of risk management requirements in MSFC programs and projects.

Project or Program Manager and Project Analysis Office 6.2.9 Ensure that program/project personnel are trained and equipped in the use of SRA tools and techniques. Support the program/project as requested in performing periodic SRA assessments.

6.3 Risk Management Tools

For CRM purposes during the formulation phase of a program or project, the type of CRM tools will be selected. In the table below, the minimum application of CRM tools required for a given type of program/project is specified. The justification for declaring a specific type of program or project will be included in the CRM and program/project plan.

Program/Project Type Guidelines:

Type I - High national prestige: high complexity, or high cost, or long program/project life. Research, Development, Test and Evaluation (RDT&E) projects with values of \$70 million or more and a period of performance exceeding one year. Also, Production projects with values of \$300 million or more.

Type II - Moderate national prestige: medium to high complexity, or medium cost, or medium program/project life. RDT&E projects with values greater than \$25 million, but less than \$70 million and a period of performance exceeding one year. Also, Production projects with values greater than \$70 million, but less than \$300 million.

Type III - Little national prestige: low complexity, or low cost, or short program/project life. RDT&E projects with values greater than \$2 million, but less than \$25 million and a period of performance exceeding 6 months.

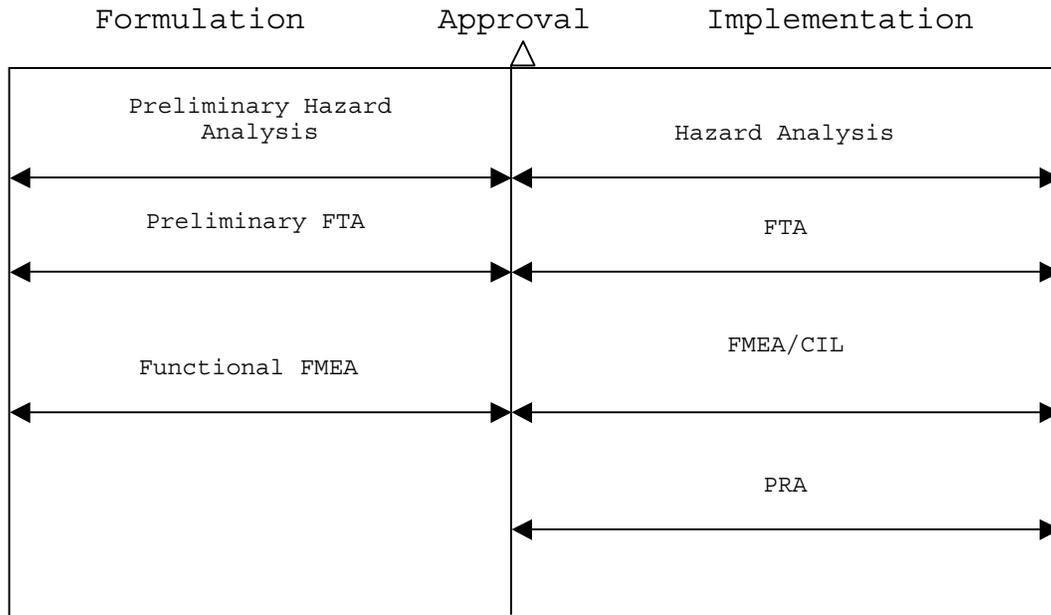
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Table 6.3	Type I	Type II	Type III
The Application of CRM Tools for a Project/Program	PRA FMEA ** FTA HA SRA	FMEA ** FTA HA SRA	FTA * HA SRA

* An FMEA may be prepared in lieu of an FTA if the risk analyst determines that the system is simple enough where concurrent faults will not effect the assessment. ** For projects and programs that do not plan to develop hardware, an FMEA will not be required.

The references in section 4 provide detailed instructions on the preparation of PRA, FMEA, FTA, SRA and HA, and also provide information on other types of RM tools. The usage of these analysis tools will start when risks are being identified and analyzed. In the formulation and approval phases of a program/project, the system architecture will be in a conceptual form so the detail of the risk assessment will not be as mature as when the program/project is in the implementation phase. The table below provides some guidance of applying these tools as the project matures. The scope and the preparing organization of the analyses will be identified in the CRM plan or program/project plan. The GPMC will concur with the scope of analysis that is specified in the plan. The analyses using the CRM tools will be updated as the system or hardware changes or matures.

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7. NOTES

None

8. SAFETY PRECAUTIONS AND WARNING NOTES

None

9. RECORDS

9.1 The Program/Project Manager will maintain the following records:

9.1.1 Continuous Risk Management Plan

9.1.2 Risk Analysis/Risk Information Sheets (or equivalent)

9.1.3 Risk Mitigation Plans

9.1.4 Risk Area Action Closures

9.2 The Employee and Organizational Development Department will maintain the NASA CRM Training records.

CRM records will be maintained throughout the life of the program/project. After the conclusion of the program or project, the CRM records will be dispositioned as specified in the project

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plans and in accordance with the "NASA Records Retention Schedules" (NPG 1441.1), Schedules 7 and 8.

10. PERSONNEL TRAINING AND CERTIFICATION

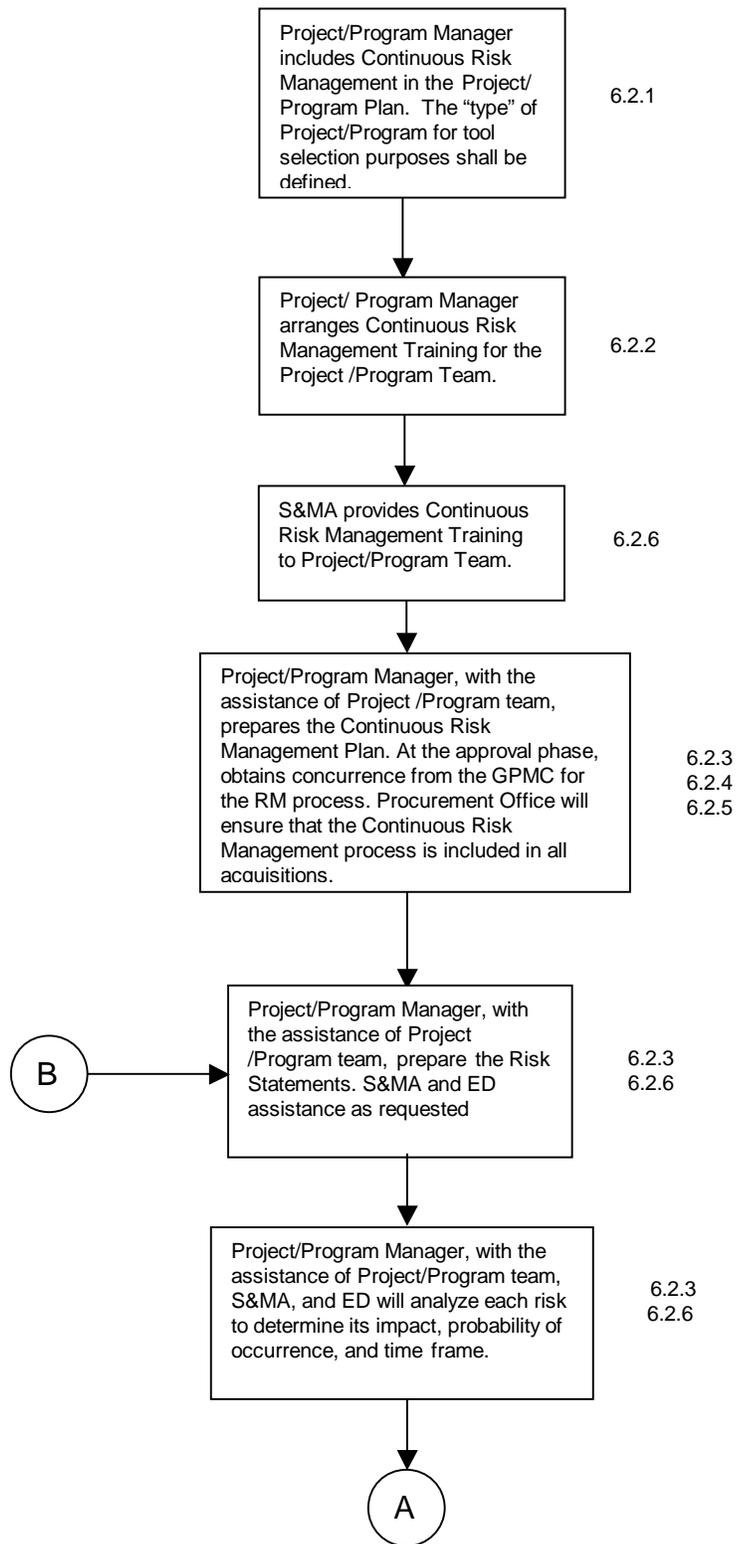
All civil service and contractor personnel that participate in risk management activities shall be trained in the NASA Continuous RM Training or similar NASA-approved training provided by the contractor.

Continuous RM training for program or project teams or groups of individuals is available upon request through the S&MA Office.

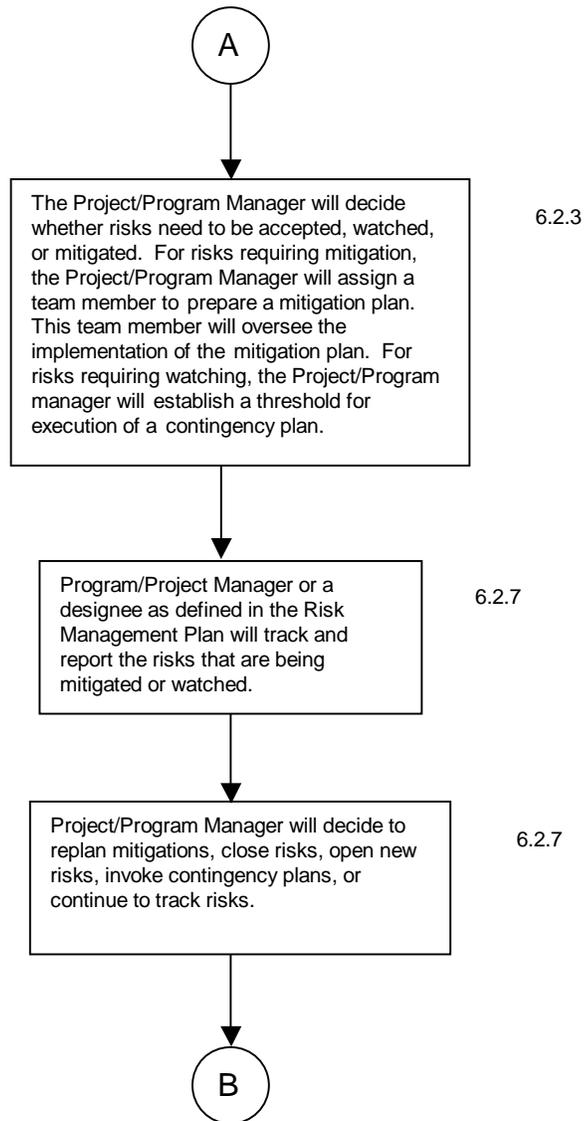
11. FLOW DIAGRAM

See following page.

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12. CANCELLATION

MWI 7120.6A dated May 15, 2001

Original signed by
Axel Roth for

David A. King
Director

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APPENDIX

ID	Risk Information Sheet		Identified
Priority	Statement		
Probability			
Impact			
Timeframe	Origin	Class	Assigned to:
Context			
Mitigation Strategy			
Contingency Plan and Trigger			
Status			Status Date
Approval	Closing Date	Closing Rationale	